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UNDERWATER ILLUMINATION PATTERN AND THE CATCH OF TWO TYPES OF BAGAN: CASES IN PELABUHAN RATU BAY AND MAKASSAR STRAIT.

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ABSTRAK

Secara umum ada dua jenis lampu yang digunakan untuk mengumpulkan ikan yang ditangkap oleh bagan, yaitu lampu petromaks dan lampu listrik. Lampu petromaks banyak digunakan pada bagan ukuran kecil (seperti bagan rakit di Pelabuhan Ratu), sedangkan lampu listrik digunakan pada bagan dengan ukuran yang lebih besar (di Selat Makassar dan Teluk Bone) disebutnya dengan bagan raksasa atau bagan rambo.

Penelitian ini dilakukan untuk mengetahui pola illuminasi cahaya di bawah permukaan air dan hasil tangkapan dari kedua tipe bagan tersebut. Pada kedalaman 8m illuminasi cahaya pada bagan rambo mencapai 47 lx sedangkan pada bagan rakit 0,1 lx. Sementara itu distribusi cahaya diudara hampir sama membentuk seperti kupu-kupu.

Jenis ikan yang paling banyak tertangkap oleh kedua jenis bagan tersebut adalah ikan teri (*Stolephorus sp*). Ikan lain yang tertangkap antara lain sardin *Sardinella sirm,* layang *Decapterus macrosoma,* lemuru *Sardinella fimbriata,* pepetek *Leiognathus splendens,* cumi-cumi *Loligo* sp dan kembung *Rastreliger kanagurta*. Ikan cakalang *Katsuwonus pelamis* dan tenggiri *Scomberomorus commersoni* hanya tertangkap pada bagan rambo. Rata-rata hasil tangkapan pada bagan rambo adalah 397 kg per trip sedangkan pada bagan rakit sebanyak 30 kg per trip..

ABSTRACT

Usually, there are two types of fishing lamp used by bagan fisherman to attract and catch fish: pressured kerosene lamp and electric lamp. The first type is commonly used on the small sized bagan like raft bagan in Pelabuhan Ratu Bay and the second type is used on the large bagan like boat bagan (known as "bagan rambo" in south Sulawesi) in Makassar strait.

The pattern of light intensity distribution of both fishing lamps in the air was almost the same, i.e., is butterfly shaped. The highest intensity was recorded at the angle of 90,° i.e., 170 lx for kerosene and 2,700 lx for mercury lamps. The pattern of the underwater light intensity was found different between the bagan. Due to the pattern of light position and lighting power, mercury lamps can illuminate deeper water column than pressured kerosene lamp. At 8m depth The underwater illumination of boat bagan and raft bagan were 47 lx and 0.1 lx, respectively.

The catch of both bagan was dominated by anchovy *Stolephorus* sp. The others species caught are spotted sardinella *Sardinella sirm,* scad mackerel *Decapterus macrosoma,* fringe-scale sardine *Sardinella fimbriata,* black tipped ponyfish *Leiognathus splendens,* squid *Loligo* sp and stripped mackerel *Rastreliger kanagurta.* Skipjack tuna *Katsuwonus pelamis* and barred spanis mackerel *Scomberomorus commersoni* were only caught by boat bagan. It is supposed that boat bagan was operated in the off-shore waters. The average catch per trip of boat bagan was 180 kg whereas for raft bagan was 30 kg.

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1. Introduction

Bamboo-platform liftnet is one of the most popular fishing methods operated around Indonesia coastal waters. It is usually operated at night using fishing lamps to attract fish. According to their mobility, there are two types of bamboo-platform liftnet: the fixed bamboo-platform liftnet (called "bagan tancap" in Indonesian) and the floating bamboo-platform liftnet (called "bagan apung" in Indonesian). The first type is made of stakes erected from the seabed and cannot be moved. The second type is not fixed but floating using boat or raft so it can be moved to preferable location. The floating bagan can be further distinguished into three types, namely; raft bagan, bagan with one boat, bagan with two boats. These floating bagan can also distinguished further into into engine powered bagan and non engine powered bagan

The first recorded bamboo-platform liftnet was in early 1950's around the South and South-east of Sulawesi Islands. Five years later this fishing gear was widely found all over Indonesian coastal waters with some improvment in the gear and fishing methods (Kawamura, et.al., 1983; Subani and Barus, 1989;). In 1999, there were 13,500 fixed bamboo-platform liftnet and 10,250 floating bamboo-platform liftnet catching a wide variety of pelagic species (Directorat General of Fisheries, 2000). Fixed bagan is widely operated in the eartern coastal waters of Sumatera, Java Sea and southern island of Sulawesi, while floating bagan is spread out in the southern coastal waters of Sumatera, Sulawesi and around Maluku islands. The south Sulawesi, there are some variations of large scale floating bagan. One of them is *bagan rambo* with 4 x 32 m length square platform or frame which generally use electric generator to power the light.

The bamboo-platform liftnet consists of bamboo-platform, watch house, roller, fishing lamps, box-shaped net and scoop net (Fig. 1). The bamboo-platform is 7 – 35 m lengths square, which provide a working place for fishers and frame for the net. The watch house

provide an observation station for monitoring school of fish attracted by fishing lamps, as well as a resting place for fishers. The function of roller is to lift the boxed-shaped net by hauling 4 hanging lines operated manually by fisher. The fishing lamps attract fish schools and keep them in the ligthed area. Under the bamboo-platform, there is a box-shaped net with a square bamboo frame suspended at a certain depth. The scoop net collects the catch from the box-shaped net. Generally, before the hauling process, the light intensity of the lamps is reduced until the box-shaped net is completely hauled.

The capture process of the bamboo-platform liftnet consist of 3 phases: the approach of fish school to the coastal area, the attraction of fish by the lamps to the area under the platform and response of fish school to the hauling process. Bamboo-platform liftnet is operated on a fishing ground awaiting the attraction of fish to light. As this gear is designed to catch the fish which can be attracted by light, understanding of fishing process of bagan is very important.

2. Material and Methods

The observation was carried out in August, 2000 in Pelabuhan Ratu Bay, West Java and Makassar strait, South Sulawesi, Indonesia. The bagans used in the observation activities in Pelabuhan Ratu Bay and Makassar strait were raft bagan and boat bagan, respectively. The bamboo-platform of raft bagan was 10 length square and the box-shaped net was 8.4 m length square times 3.6 m, with 0.5 cm mesh size. The net is suspended by 4 hanging ropes at 12 m depth. 4 unit pressured kerosene lamps are used to attract the target species. The raft bagan was operated at the fishing ground of 25 m depth.

The size of boat of boat bagan was 30 m length, 3.5 m breath and 2 m depth. Its box-shaped net was 31 m length square times 17 m, with 0.5 cm mesh size. 4 corner ropes at 20 m depth suspended the net. For fish attraction the boat is equipped by 60 unit mercury lamps,

each lamp is 250 watt. The boat bagan was operated in the water depth of 70 m.

The illumination pattern of both fishing lamp (kerosene and electric lamps) in the air was measured by a digital lux-meter DX 100 model, measuring point at every 10 degree in arch around the lamp with 1 m range from the lamp. The underwater light intensity of both bagan was measured by an underwater light meter 16648 model. Data were observed at every operation by considering to the catch species and total catch.

3. Result and Discussions

The profile of light intensity

The lighting pattern of a pressured kerosene lamp in the air was like a butterfly shape (Fig. 2) due to the shape of lamp consisted of kerosene tank at bottom and lamp shade on top. The highest light intensity exists at both sides of angle of 90° of the butterfly shape as 170 lx at 1 m distance. The light intensity was decreased gradually with lower intensity of 70 lx at the bottom area under the kerosene tank.

Lighting condition of a mercury lamp in the air showed a similar pattern with a kerosene lamp. The highest light intensity exists at both sides of the butterfly shape as 2,710 lx at 1 m distance. The light intensity was decreased gradually with lower intensity of 189 lx and 722 lx at the upper and the bottom area, respectively (Fig. 3).

The result of measurement of underwater light intensity distribution of raft bagan showed that the iso-lux contour pattern of 4 pressured kerosene lamps is simple with an oval shape of maximum light intensity of 250 lx just below the surface to 0.1 lx in 8 m depth (Fig. 4).

The distribution of underwater light intensity of boat bagan showed that the iso-lux contour pattern of mercury lamps look like a wave shaped. The light intensity maximum

was observed just below the water surface at 6 m distance from the center of boat, that was 120 lx (Fig. 5).

The underwater light intensity distribution was affected by several factors such as ; the light conditions above the surface, the light reflection and refraction from the surface, as well as absorption. The absorption depends upon the wavelength of the light, while the scattering was affected mainly by the amount and nature of suspended matter, either in the form of mineral suspension or organic compounds (Hela and laevastu, 1961). The oval shape of light intensity distribution of pressured kerosene lamp in raft bagan have the deepest part in the center. It is because the design of lamp position in raft bagan that is at the center of platform. The light goes directly vertical through the water surface will all goes into the water without reflection and dispersion. Otherwise in case of boat bagan, the distribution curve of underwater light intensity look like a wave shaped. It is because the number and position of lamps in boat bagan that is spread design on the platform, so that the light shall be some reflected and some other be dispersed when goes into the water. This condition more gives possibility to attract the target species from wider and deeper areas due to the size of bagan.

Catch analysis

Bagan fishery was introduced since 1955-1956 in Pelabuhan Ratu Bay, where fixed bagan was firstly developed by fisher from south Sulawesi. And then, from 1978 until now they have been developing about floating bagan. In 1999, there were 150 units floating bagan which were operated in Pelabuhan Ratu Bay (Fig. 6) with the average of catch per night per unit was 30 kg (Fig. 7).

The catch of raft bagan is rarely composed only single species. Frequently, there were consisted of various fish species caught in every hauling operation. During the observation, fishing ground had been influence by west monsoon. In that season hard wind and rough sea

usually occur, but in the other hand base on previous fish catch landed data in Pelabuhan Ratu, during that season fish is in abundance or also called as "fish season" by local fishermen in that area especially for small pelagic fish. That phenomena is also shown in this observation where fish catch composition of raft bagan was dominated by anchovy *stolephorus* sp (25 %). The other main catch during observation are squid *Loligo* sp (15 %), paste shrimp *Acetes* sp (10 %), fringe-scale sardine *Sardinella fimbriata* (9 %), black tipped ponyfish (8 %), hairtail *Trichiurus savala* (6 %), spotted sardinella *Sardinella sirm (6%),* scad mackerel *Decapterus macrosoma* (5 %), spotted moonfish *Mene maculata* (5 %), striped mackerel *Rastrelliger kanagurta* (5 %), purse-eyed scad *Selar crumenophthalmus* (4 %) and fish larvae (2 %). The catch composition of raft bagan can be seen in Figure 8.

In Sulawesi island, the bagan fishery was developed in early 1950's which is the first historical record for bagan in Indonesia. In south Sulawesi, there are some variations of large scale of boat bagan (called "bagan rambo" in south Sulawesi) which have 30-35 m length square platform. They used electric generator for electric lamps to attract fish school in operation. In 1999, there were 360 unit boat bagan which were operated in Makassar strait (Fig. 9) with the average of catch per night per unit was 180 kg (Fig. 10).

Boat bagan is very important role in utilization of pelagic fish resources in Makassar strait. The catch composition of boat bagan was also dominated by anchovy, that was 30 % in average of total catch (Fig. 11). The other species are scad mackerel (20 %), fringe-scale sardine (15 %), striped mackerel (10 %), spotted sardinella (8 %), squid (7 %), skipjack tuna *Katsuwonus pelamis* (5 %) and barred spanis mackerel *Scomberomorus commersoni* (5 %) (Mallawa, et.al., 1991; Nadir, 2000).

The catch of bagan is greatly depending on species, typical migration and behavior pattern of fish at around the lighted area. The migration of fish to the coastal area frequently at dawn and dusk with fewer species but larger size of school. The behavior of them to the

light affects the catch of bamboo-platform liftnet. For example, striped mackerel and purse-eyed scad come to the lighted area only for food. They rapidly come to under the lamp, and to predate their preys that were gathering around the lighted area, and then immediatelly swim out from the lighted area. Thus, these species are very dificult to be caught, especially for bamboo-platform liftnet with manual hauling process. While, for squid and anchovy that are species which attracted by the lamp, they come to the lighted area for more longer time. Thus, they could be easly caught by bamboo-platform liftnet eventhough by manual hauling (Baskoro, 1999). Many fish species are attracted to the illuminated zone, but the strength of their reaction to light varies in each species (Nikonoron, 1975). The catch quality and quantity depends on the migrating behavior of fish schools approaching the coastal area and their reaction to the gear (Inoue and Arimoto 1988).

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A

A = bamboo-platform
B = watch house
C = roler

B

1. = boat
2 = platform
3 = electric lamp
4 = watch house
5 = roller

Figure 1. The Floating Bamboo-platform Liftnet

A =Raft Bagan B = Boat Bagan

Figure 2. The lighting pattern of a kerosene lamp in the air

Figure 3. The Lighting of a Mercury Lamp 250 watt in the air.

Figure 4. The underwater light intensity Distribution Pattern of Raft Bagan

Figure 5. The Underwater Light Intensity Distribution Pattern of Boat Bagan

Figure 6. Number of Raft Bagan in Pelabuhan Ratu Bay, 1994 -1999

Figure 7. CPUE of Raft Bagan in Pelabuhan Ratu Bay, 1994-1999

Figure 8. The Catch Composition of Raft bagan

Figure 9. Number of Boat Bagan in Makassar Strait, 1994-1999

Figure 10. CPUE of Boat Bagan in Makassar strait, 1994-1999

Figure 11. The catch composition of Boat Bagan